



Additional Turmeric Powder (Curcuminoid) into Traditional Ration to Improve the Productivity of Bali Pig



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Abstract

Bali Pig is one of germplasm whose existence is very limited until now. This is due to the very low growth and breeding compared to other types such as Landrace pigs, Duroc, and Laghwhite. However, Bali pig has an advantage among others such as able to utilize lack quality feed so it is suitable to maintain in rural areas. To keep the existence of Bali pig, a necessary attempt needed to avoid extinction. One of its ways is to make improved feed by adding turmeric powder (curcuminoid). The benefits of giving curcuminoid are able to increase the appetite, increase the utilization of nutrients such as fats, proteins, and carbohydrates. This research method used a Complete Randomized Design (CRD) with 4 treatments and 4 replications. The treatments were: Treatment A: swine rations that did not contain turmeric powder (extract curcuminoid), Treatment B: swine rations contained turmeric powder (extract curcuminoid), 0,02 ml/1 kilogram body weight, Treatment C: swine rations contained turmeric powder (extract curcuminoid 0.04 ml/1 kilogram body weight), and Treatment D: swine rations contained turmeric powder (extract curcuminoid). 0,06 ml/1 kilogram body weight. Observed variables included consumption, overall weight gain, daily weight gain, FCR, and digestibility. The results showed that the average consumption and weight gain in treatment curcuminoid 0,04/1 kilogram bodyweight showed the highest result among the four treatments. Level FCR in 0,04 ml/1 kilogram bodyweight curcuminoid treatment showed the most efficient result and the dry matter digestibility showed significant results ($P < 0.01$). However, organic matter digestibility, crude fiber, and protein digestibility showed a non-significant ($P > 0.01$) result. Overall, ration treatment with curcuminoid 0,04 ml/1 kilogram bodyweight showed the best results.

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Up to now, meat consumption in Indonesia has reached 7.5 kg/capita/year, equivalent to 4.5 grams of animal protein/capita/day. Report from Directorate General of Animal Husbandry states that in 2019, people of Indonesia expected to consume 15 grams of protein/capita/day, equivalent to 25.2 kg of meat, eggs 10.4 kg and 19.3 kg milk/capita/year. Pig Farm donation in providing new meat reached 12.6% of total national meat production. Given this reality, pig production needs to increase in order to meet the fulfillment of pork meat. Bali Pig is one of Indonesia's original livestock that has potentiality as a meat contributor due to Bali Pig can grow well even they were given food with motto good quality. In addition, its maintenance does not need a good management as good as other races. Nevertheless, giving too bad food quality will disrupt its growth. To improve the productivity of Bali pig can be done with the improvement of the feed and one of them is by providing materials that can improve the utilization of food substances. One alternative that can also be done is to provide a feed additive such as turmeric powder (a curcuminoid)

Provision of turmeric powder (a curcuminoid) on traditional ration aims to improve Bali pig's growth through improving the digestion of nutrients and improving the efficiency of feed utilization. The use of turmeric is technically very easy to do, which is by mixing it in rations. Besides, turmeric price is very cheap, so it does not cause an increase in the price of the ration. Provision of turmeric in the traditional ration of Bali Pig expected to increase its productivity on farmers. Because during the breeding, the local farmer still doing it traditionally where many are never caged even given rations with a very bad quality.

According to Riyadi (2009), the rhizome of turmeric plant is useful as an anti-inflammatory, anti-oxidant, anti-microbial and turmeric can improve the digestive organ's work. Turmeric can stimulate the walls of the gallbladder to secrete bile and stimulates the release of pancreatic juice containing enzymes amylase, lipase and protease that is useful to improve digestion of feed ingredients such as carbohydrates, fats, and proteins. Besides, the essential oils contained in turmeric may accelerate gastric emptying. Based on the above conditions it is necessary to study the use of turmeric as a feed additive in swine rations Bali Pig. Bali Pig farming is a selection for underprivileged families. Despite the fact of its slow growth rate, Bali pig breed still demanded due to its water saving and easy maintenance. To keep Bali pig survives and not extinct, one of the solutions is by providing a feed additive turmeric extract (a curcuminoid) so it grows faster.

2. Materials and Methods*2.1 Animal and Design*

This study used 16 Bali weaning pigs that been castrated. The experimental design used was Complete Randomized Design (CRD) with 4 treatments and 4 replicates used. The treatments were

Table 1
The composition of treatment rations composer

Rations Composer %	Treatment ¹⁾			
	A	B	C	D
a. Concentrate	25	25	25	25
b. Polar	25	25	25	25
c. Yellow corn	25	25	25	25
d. Banana stem	25	25	25	25
e. Turmeric flour	0	0,02	0,04	0,06
Total	100	100	100	100

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Information:

Treatment A: swine rations that do not contain extract (*curcuminoid*)

Treatment B: swine rations containing 0.02 ml / 1 kg turmeric extract (*curcuminoid*)

Treatment C: swine rations containing 0.04 ml / 1 kg turmeric extract (*curcuminoid*)

Treatment D: swine rations containing 0.06 ml / 1 kg turmeric extract (*curcuminoid*)

Table 2
Rations gynecology research

Nutritional content (%)	A	B	C	D	Standard*
ME (kkal/kg)	3258	3258	3258	3258	3260
Protein	17,33	17,33	17,33	17,33	18
Crude fiber	15,05	15,05	15,05	15,05	15
Ash	3,92	3,92	3,92	3,92	6,8
Ca (ppm)	0,52	0,52	0,52	0,52	-
S (ppm)	1,61	1,61	1,61	1,61	-
Curcuma	-	3,26	3,32	3,39	3,2- 6

* Laboratory Analysis Results Livestock Research Center Ciawi Bogor. Standard based on [NRC \(2012\)](#)

This research conducted in Candikusuma village of Melaya District, Jembrana Regency. Length of the study predicted for 6 months with 1-month allocation for preparation in the field (such as preparation of seedlings, cages, feed, and adaptation), 4 months, and 1-month data collection study in the laboratory. Livestock used in this study were male Bali pigs that been weaned and were already castrated with an average body weight of 11 kg. The number of livestock used as many as 16 livestock, kept in a cage for 4 months. Cages used were individual cages with a length of 2 m, width 0.75 m and 1.25 m high. Each unit is equipped with a cage to eat and water to drink. Before being treated, the pigs were given vaccine SE and medicine to treat worms.

Substance turmeric (*curcuminoid*) used in this study were turmeric powder which was traditionally made by grinding and then squeezed in order to obtain extracts of turmeric. Making the turmeric extract is done every day, so it is not damaged. Rations used were the traditional feed ingredients that used by farmers in rural ranchers. Those materials were concentrates, polar, corn and banana stem. The provision of banana stems made freshly form a sliced banana stem and pounded. Add turmeric powder and then mixed with commercial feed homogeneously. Feeding by daily mixed. Rationing did by ad-libitum, twice a day, at 07:00 pm and 17:00 pm. The rest of the ration weighing done every day at 6:30 pm. Provision of drinking water also done on ad-libitum.

2.2 Variables Measurements

Feed intake measured by counting the amount of feed given every day reduced by food remains on the very same day. Livestock growth calculated by weighing pigs every 2 weeks, then weight gained calculated by subtracting the final weight with the initial weight divided by the length of the study. Feed Conversion Ratio (FCR) sought by dividing the consumed rations with weight gain pigs.

Ration digestibility measured by total collection techniques [AOAC \(1990\)](#). That measure the dry matter intake and total dry matter manure produced. Digestibility of dry matter, organic matter, crude fiber, and crude protein can be calculated by the formula:

a) Dry Material Digestibility (DMD)

$$\text{DMD} = \frac{\text{Dry Material intake} - \text{Dry Material feces}}{\text{Dry Material intake}} \times 100\%$$

b) Organic Materials Digestibility (OMD)

$$\text{OMD} = \frac{\text{Organic Material Consumption} - \text{Organic Materials feces}}{\text{Organic Material Consumption}} \times 100\%$$

c) Crude Fiber Digestibility (CFD)

$$\text{CFD} = \frac{\text{Consumption of raw fiber} - \text{Fiber rough feces}}{\text{Dry matter intake}} \times 100\%$$

d) Digestible Crude Protein Coefficient (DCPC)

$$\text{DCPC} = \frac{\text{Consumption of protein} - \text{Protein feces}}{\text{Consumption of protein}} \times 100\%$$

2.3 Statistical Analysis

Researched data analyzed by ANOVA (Analysis of Variant). When there was the significantly different result ($P < 0.05$), then continued with Duncan's multiple range test at 5% level. The relationship among consumption, digestibility, and weight, it gains were analyzed by Correlation Analysis (Steel and Torrie, 1991).

3. Results and Discussions

Turmeric is a type of *rizhome* that contains active substances such as essential oil and curcumin compound. The very useful chemical is curcumin from *hatanoid*, which gives a yellow color. Besides, it has *tumeron*, *zingiberene* that serves as an anti-bacterial, anti-oxidant, and anti-inflammatory and has oil starch comprising *turnerol*, *phellandrene*, *kanfer*, *curcumin*, and others. Research result showed the average consumption value of 0.04 turmeric extract (*a curcuminoid*) was the lowest among the four treatments, but statistically showed a significant difference ($P > 0.05$). While for the growth of body weight, showed the highest among the four treatments, although not statistically significantly different ($P > 0.05$). Thus proved that turmeric gives the fragrance and taste of rations resulting efficiency in the use of feed ration due to the consumption is slightly lower since the feed quality is good. According to Sinaga (2011), good quality nutrient determines consumption and livestock's weight gain. Adding extract of turmeric (*a curcuminoid*) as the feed additive in pig's ration gave significant effect on feed conversion. Giving as much as 4 mg / kg of body weight gave the best effect on feed conversion and growth rate Sinaga and Martini (2011).

Table 3
Consumption, WG, WG/day and FCR

Variables	Treatment ²⁾				SEM ³⁾
	A	B	C	D	
Consumption (kg / h) DM	0,84 ^a	0,81 ^a	0,78 ^a	0,79 ^a	0,07
Weight Gain (kg)	27,00 ^a	27.75 ^a	30,50 ^a	29,25 ^a	3,26
Weight Gain / day (kg)	0,22 ^a	0,23 ^a	0,25 ^a	0,24 ^a	0,03
FCR (kg)	3,81 ^a	3,60 ^a	3,11 ^a	3,27 ^a	0.47

Information:

Treatment A: swine rations that do not contain extract (*curcuminoid*)

Treatment B: swine rations containing 0.02 ml / 1 kg turmeric extract (*curcuminoid*)

Treatment C: swine rations containing 0.04 ml / 1 kg turmeric extract (*curcuminoid*)

Treatment D: swine rations containing 0.06 ml / 1 kg of extract of turmeric (*curcuminoid*)

FCR is conversing consumed feed with weight gain. In this study, the effect of turmeric extract at the level of 0.04/1 kg body weight actually provides the most efficient results among the four treatments. It is because the functions and uses of turmeric gave fragrance and flavor, and act as bactericidal against a group of bacteria *Bacillus cereuss*, *Bacillus subtitis*, and *Bacillus megaterium*. Therefore, it could increase feed intake and could efficiencies streamline of the digestive tract so it digestion becomes more efficient. Besides, additional *turmeric* extract can inhibit the growth of vegetative cells of *Bacillus* and inhibit the growth of spores. The orange-yellow color contains in turmeric gave gentle disposition, antibacterial, anti-inflammatory, and facilitates bile expenditure (*Agustina and Sri, 2009*).

Table 4
Digestibility Coefficients

Variables	Treatment ²⁾				SEM ³⁾
	A	B	C	D	
Dry Matter digestibility coefficient (%)	70,52 ^a	72,67 ^a	74.81 ^a	75,59 ^a	4,76
Organic Matter digestibility coefficient (%)	72,60 ^a	73,75 ^a	74,46 ^a	72,97 ^a	3,08
Crude Fiber digestibility coefficients	83,32 ^a	83,22 ^a	83,12 ^a	83,03 ^a	3,08
Crude Protein digestibility coefficient	66,22 ^a	72,51 ^a	72,59 ^a	72,32 ^a	2,08

Information:

Treatment A: swine rations that do not contain extract (*curcuminoid*)

Treatment B: swine rations containing 0.02 ml / 1 kg turmeric extract (*curcuminoid*)

Treatment C: swine rations containing 0.04 ml / 1 kg turmeric extract (*curcuminoid*)

Treatment D: swine rations containing 0.06 ml / 1 kg of extract of turmeric (*curcuminoid*)

The research resulted that the average value of Dry Matter digestibility coefficient in the four treatments showed the higher administration of turmeric extracts (*curcuminoid*) can increased dry matter intake in rations because of the function of the turmeric extract in the feed itself. The better quality of forage dry matter intake in the feed was better. While for the crude fiber digestibility, the condition was the contrary. The higher administrations of turmeric extract (*curcuminoid*) made the value of dry matter became smaller. However, both showed statistically significant different results ($P < 0.05$). That because one of the turmeric benefits which produces *choloretic* effect caused the peristaltic motion of the digestive tract slower, consequently *digesta* stayed longer in the intestine. These conditions resulted in the digestion and absorption of nutrients in the digestive tract increased (*Ramaprasad and Sri Martini 1985 in 1998*).

Indigestibility coefficient of organic matter and crude protein, level 0.04 turmeric extract (*a curcuminoid*) showed the best results. The results obtained were significantly different ($P > 0.05$) because turmeric extract could increase the production and secretion of bile into the small intestine so that digestion of fats, protein, and carbohydrates increased. According to *Martini (1998)*, the increased digestibility of fat, protein, and carbohydrates will be followed by the increment of feed absorption and thus may cause increment on body weight gain and better feed efficiency.

4. Conclusion

Giving Bali Pig rations with 0.04 turmeric extract (*curcuminoid*) gives the best results among the four treatments and Giving Bali Pig rations with 0.04 turmeric extract (*curcuminoid*) can increase weight gain, feed efficiency (FCR), and improves feed digestibility.

Conflict of interest statement and funding sources

The author(s) declared that (s)he/they have no competing interest. The study was financed by the authors.

Statement of authorship

The author(s) have a responsibility for the conception and design of the study. The author(s) have approved the final article.

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